Ken Sukow IEE Standards
C.1
5-8-188

INSTRUCTION MANUAL

FOR

OPERATING AND MAINTENANCE

OF

VOLT–AMP–WATTMETERS

MODEL VAW

TYPE Transformer Coupled Dynamometer

ACCURACY .5 of 1% on Volts or Amperes
.75 of 1% for Watts

SCALE LENGTH 5.2 inches

Symbol of Quality

SENSITIVE RESEARCH
INSTRUMENT CORPORATION
NEW ROCHELLE, NEW YORK.

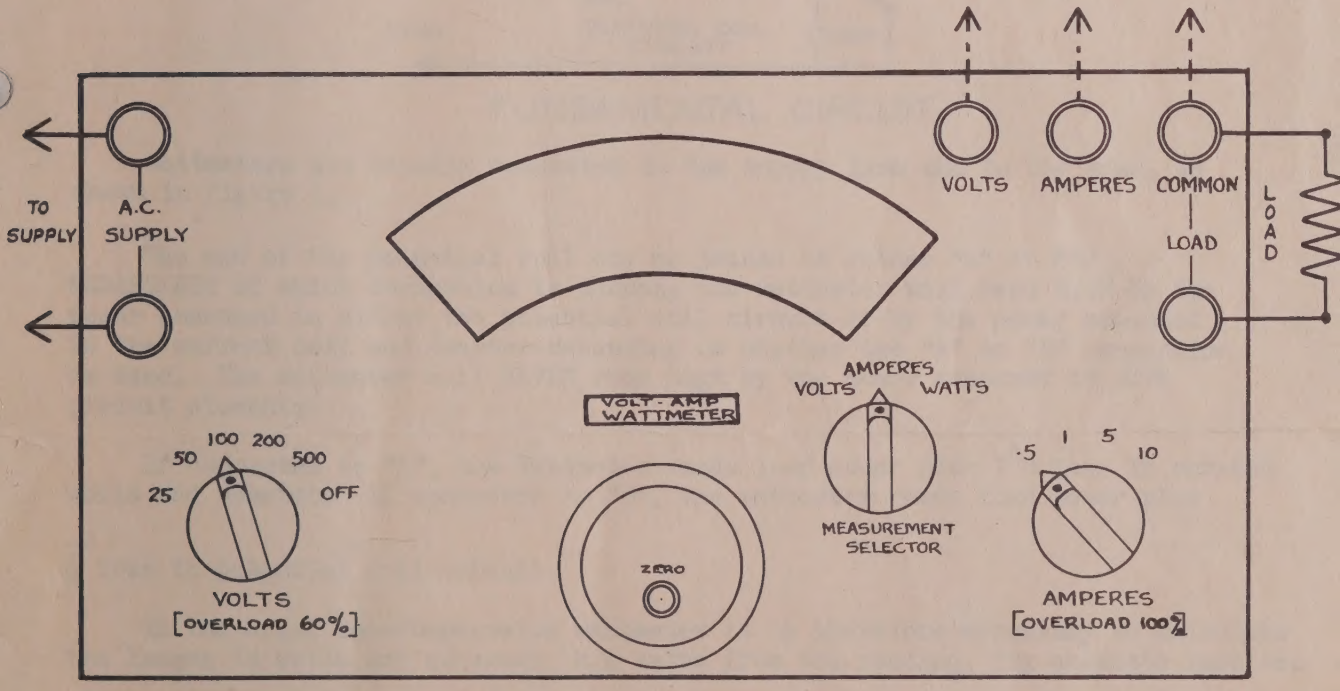
ELECTRICAL INSTRUMENTS OF PRECISION SINCE 1927

VOLT-AMP-WATTMETER

DESCRIPTION:

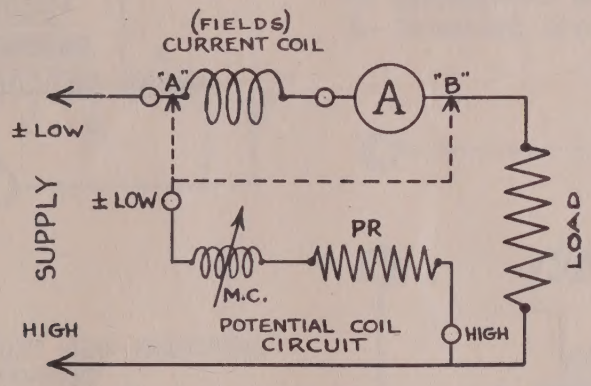
The VAW is a shielded electrodynamometer using internal switching with an instrument transformer, together with the necessary resistors, and switching to allow it to be used as a voltmeter, an ammeter or a wattmeter. The circuit is such that measurements of voltage across a load, current into a load and watts consumed by a load can be read directly WITHOUT CORRECTION for instrument losses.

The circuit is also so designed that, when used with the "AC Supply," common and "load" terminals only, no switching change will affect externally either the line or load side in changing from "Volts to Amps or to Watts." This eliminates any circuit readjustments when reading these separate values.



The VOLT-AMP-WATTMETER is completely compensated and NO calculations are necessary by the user. Compensation is accomplished by a special winding "A" on the internal current transformer which opposes the normal LOAD CURRENT flux by the current flowing in the potential circuit, This reduces the wattmeter reading by the amount of power lost in the potential circuit and therefore the VOLT-AMP-WATTMETER indicates true load WATTS.

All non-compensated wattmeters read high by the power consumed in the usual wattmeter potential circuit or the power lost in the current circuit, depending upon the connections used. See figure 1 below.



FUNDAMENTAL CIRCUIT

Wattmeters are usually connected to the supply line and to the load, as shown in figure 1.

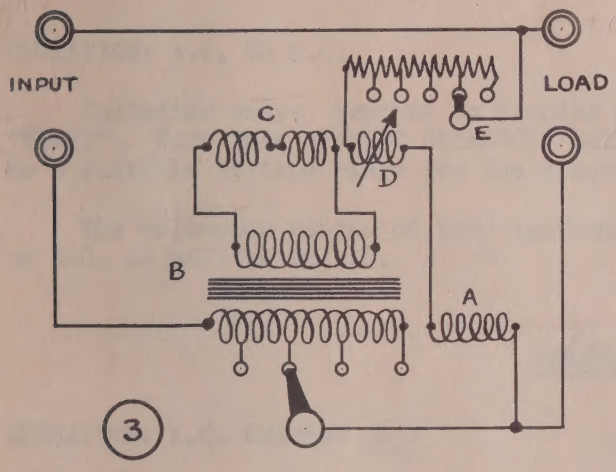
The end of the potential coil can be joined to either "A" or "B." REGARDLESS of which connection is chosen, the wattmeter will read HIGH by the power consumed in either the potential coil circuit or by the power consumed in the current coil and ammeter-depending on whether the "A" or "B" connection is used. The wattmeter will NEVER read high by the power consumed in BOTH circuit elements.

If connected to "A", the wattmeter reads load power plus I^2R loss in current coils and ammeter. If connected to "B", the wattmeter reads load power plus $\frac{E^2}{R}$ loss in potential coil circuit.

In the usual non-compensated wattmeter it is therefore necessary to calculate the losses in watts and subtract this value from the reading, for accurate results.

In our VOLT-AMP-WATTMETER we use the "B" connection and internally compensate for the potential circuit losses.

The internal instrument circuit is so designed that in measuring the VOLTS or AMPERES of the load being measured, the operation of the selector switch DOES NOT affect the load and supply circuits whatsoever. See figures 3,4, and 5.



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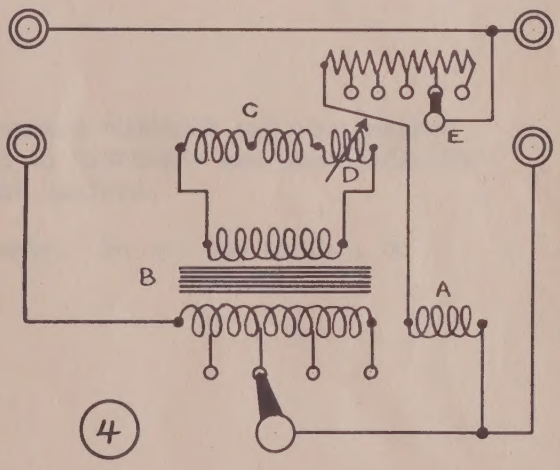
INTERNAL CIRCUIT WHEN MEASURING WATTS

A- Compensating Winding
B- Instrument Current Transformer
C- Dynamometer Field Coils
D- Dynamometer Moving Coil
E- Potential Circuit Resistances



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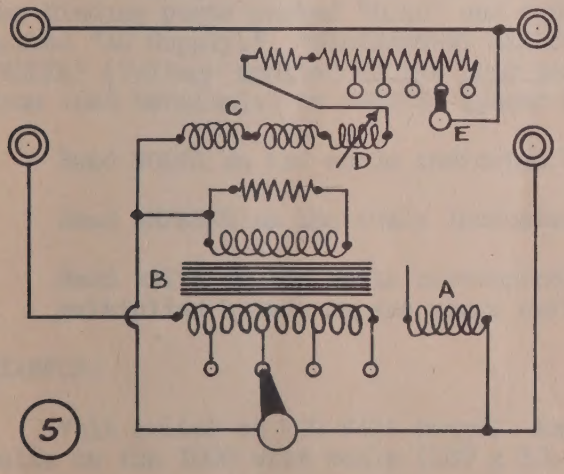
INTERNAL CIRCUIT WHEN MEASURING LOAD CURRENT

Note: Potential circuit is still connected across load, but its current drain is NOT included in ampere reading.



INTERNAL CIRCUIT WHEN MEASURING LOAD VOLTAGE

Note: Instrument transformer is still connected in Circuit.

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All the above circuits are controlled by internal switching which action will not cause errors in any measurement.

VOLTMETER

OPERATION: A.C. OR D.C.

Voltmeter only: Connect to binding post marked "COMMON" and to post marked "VOLTS". Turn "MEASUREMENT SELECTOR" switch to "VOLTS" and turn "VOLTAGE" switch to a suitable Voltage range for the measurement desired.

The voltmeter ranges of this instrument WHEN CONNECTED AS ABOVE may be used on D.C. as well as on A.C.

AMMETER

OPERATION: A.C. CURRENT ONLY

Ammeter only: Connect to binding post marked "COMMON" and post marked "AMPERES." Turn "MEASUREMENT SELECTOR" switch to "AMPERES" and turn "AMPERES" switch to a suitable range for the measurement desired.

The ammeter ranges are for use on A.C. only. Do not use on D.C. or instrument may be damaged.

WATTMETER

OPERATION: A.C. ONLY

WATTMETER, VOLTMETER, and AMMETER: Connect the load being measured to the two binding posts marked "LOAD" and connect the power source to the two terminals marked "AC Supply." "MEASUREMENT SELECTOR" switch can now be turned to measure "VOLTS" (Voltage applied to the load terminals,) "AMPERES" (Current being drawn from load terminals) or "WATTS" (power being delivered to load terminals.)

Read VOLTS on the scale indicated by "VOLTAGE" switch setting.

Read AMPERES on the scale indicated by "AMPERE" switch setting.

Read WATTS on the scale corresponding to the voltage range switch setting multiplied by the ampere range switch setting.

EXAMPLE:

Volt switch on 100 Volt range. Ampere switch on the 10 ampere range. Read watts on the 1000 watt scale (100 x 10.)

For this operation using "AC Supply" and "Load" terminals A.C. only may be used. Do not operate on D.C. or instrument will be damaged.

All of the above measurements can be completed in a very few moments without changing any connections nor does the load on the power supply change for any range or for any position of the V.A.W. switch.

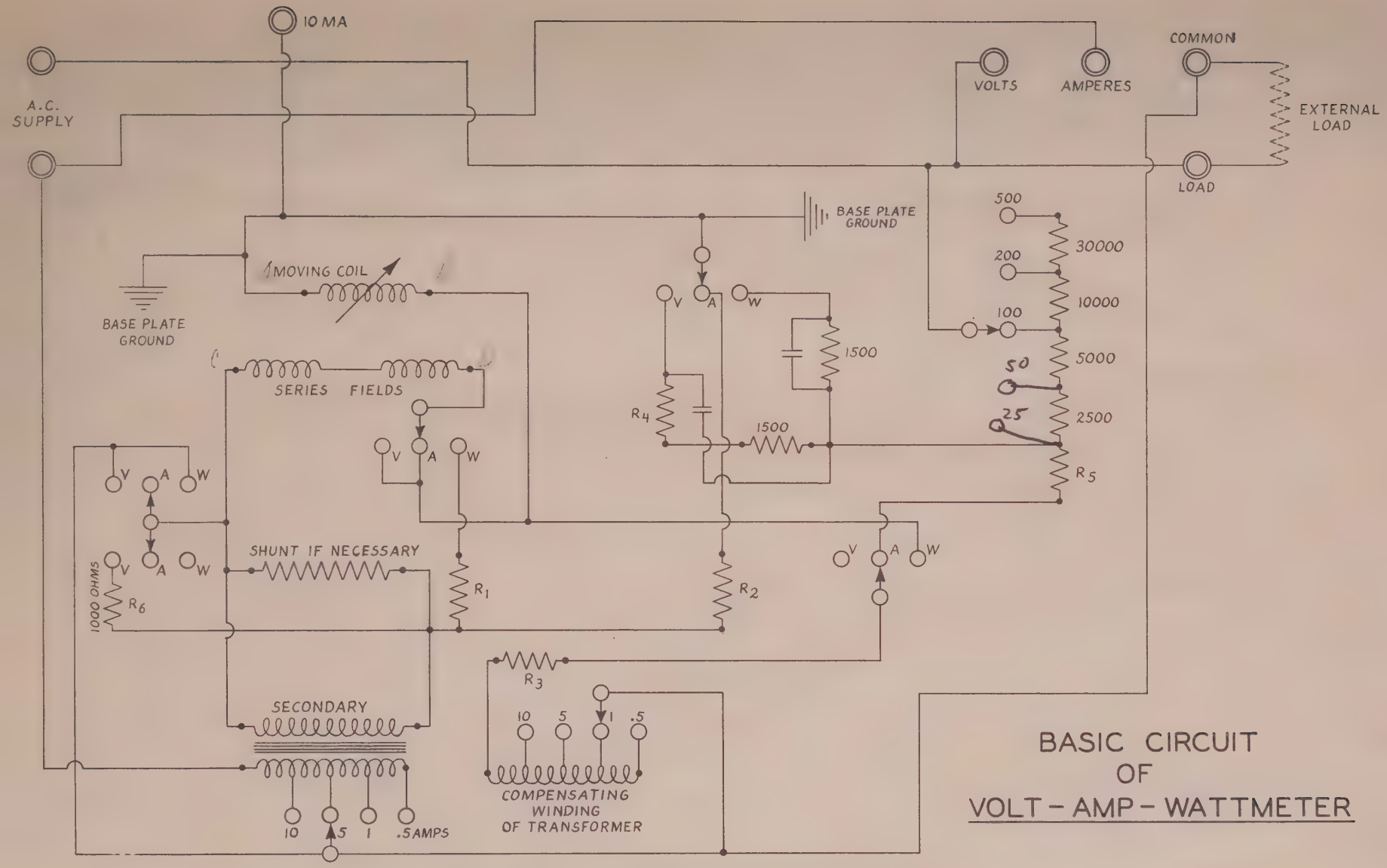
The power factor of the load can be readily calculated by

$$P.F. = \frac{\text{Watts Reading}}{\text{Volts x Amperes}}$$

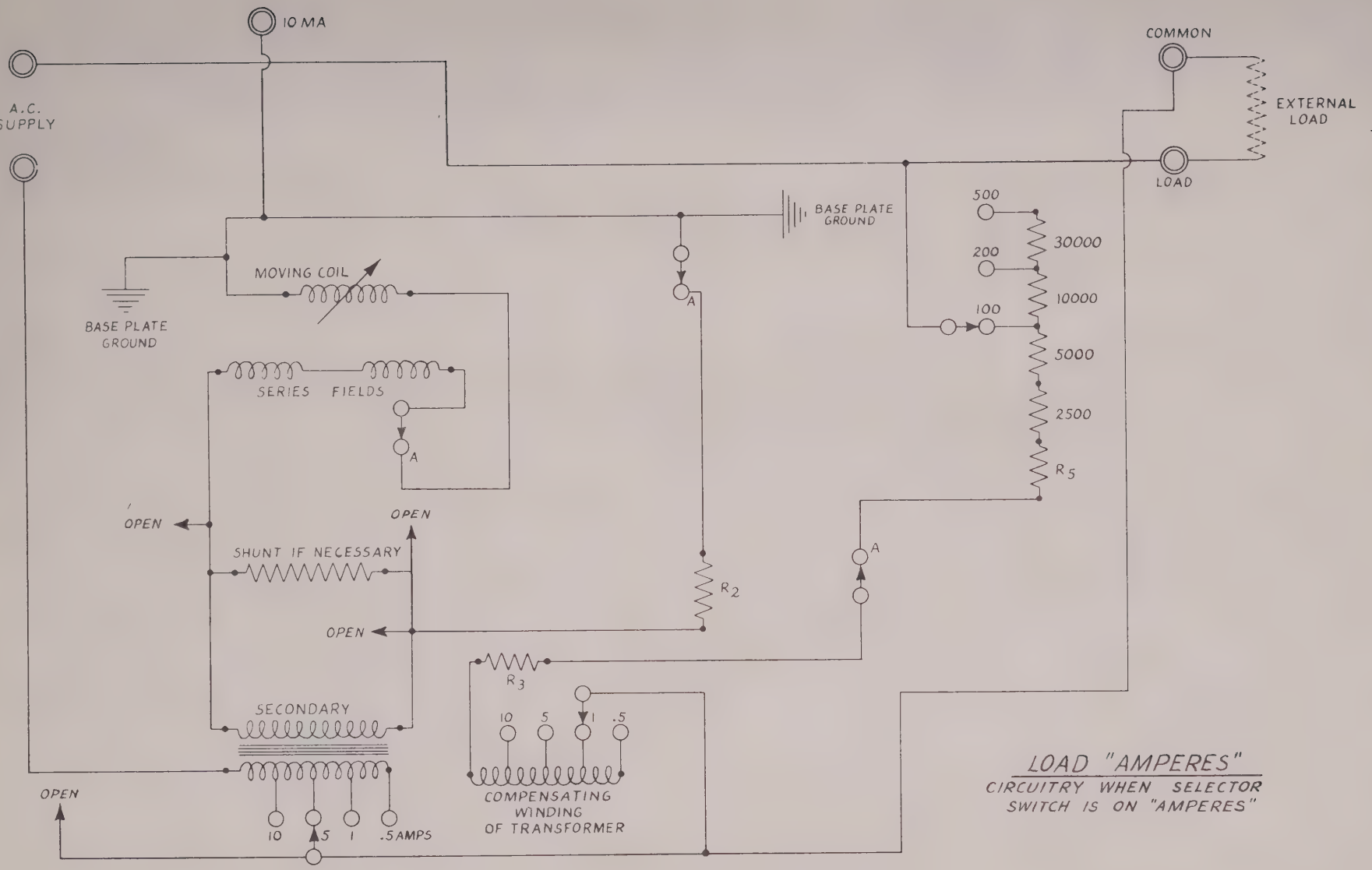
Accuracy:

	.5%	for Volts and Amperes	50-133 Cycles
Code	.75%	for Watts and 100% P.F.	50-133 Cycles
VOLTAWATT	1.5%	for Watts at 50% P.F.	50-133 Cycles

Code	Same as above (VOLTAWATT) plus the following.		
VOLTOWATT	.5%	for Volts and Amperes to	800 Cycles
only	1.5%	for Watts and 100% P.F. to	800 Cycles
	3%	for Watts at 50% P.F. to	800 Cycles

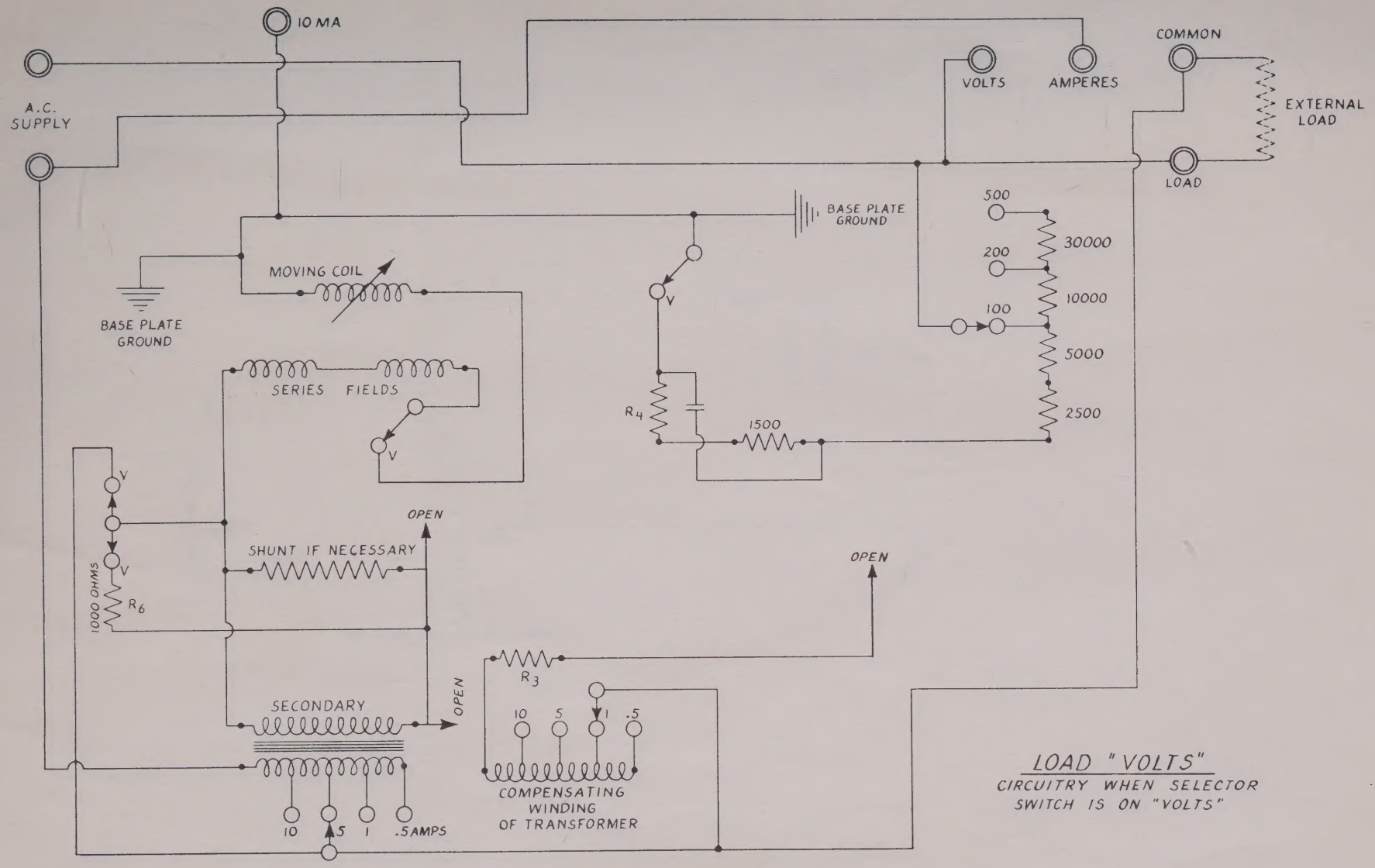


BASIC CIRCUIT OF VOLT – AMP – WATTMETER



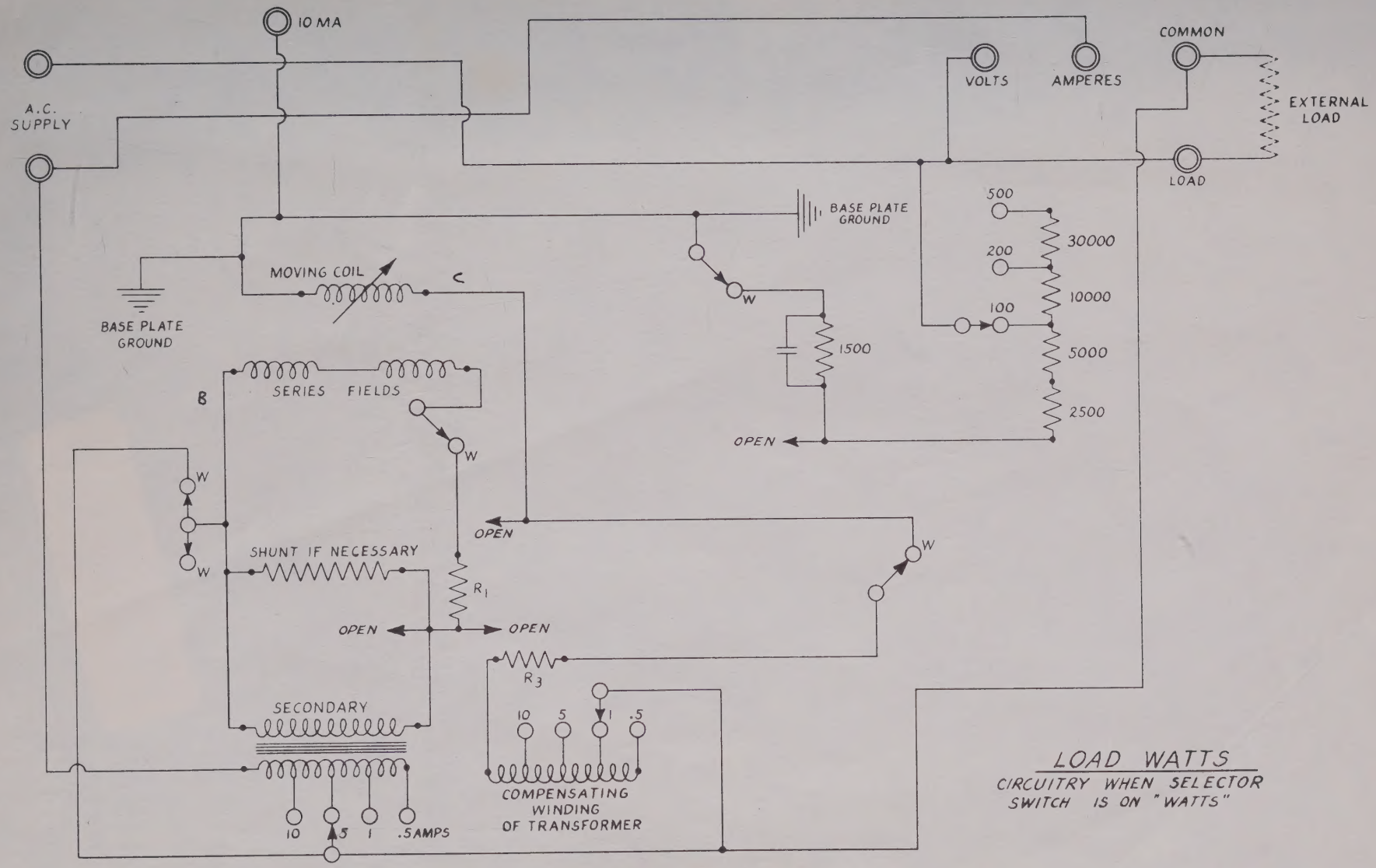
LOAD "AMPERES"

CIRCUITRY WHEN SELECTOR SWITCH IS ON "AMPERES"



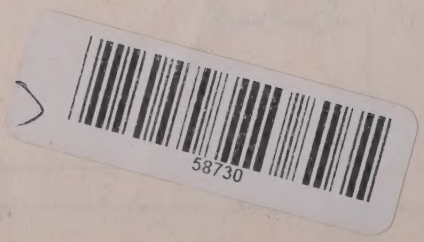
LOAD "VOLTS"

CIRCUITRY WHEN SELECTOR SWITCH IS ON "VOLTS"



LOAD WATTS

CIRCUITRY WHEN SELECTOR SWITCH IS ON "WATTS"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